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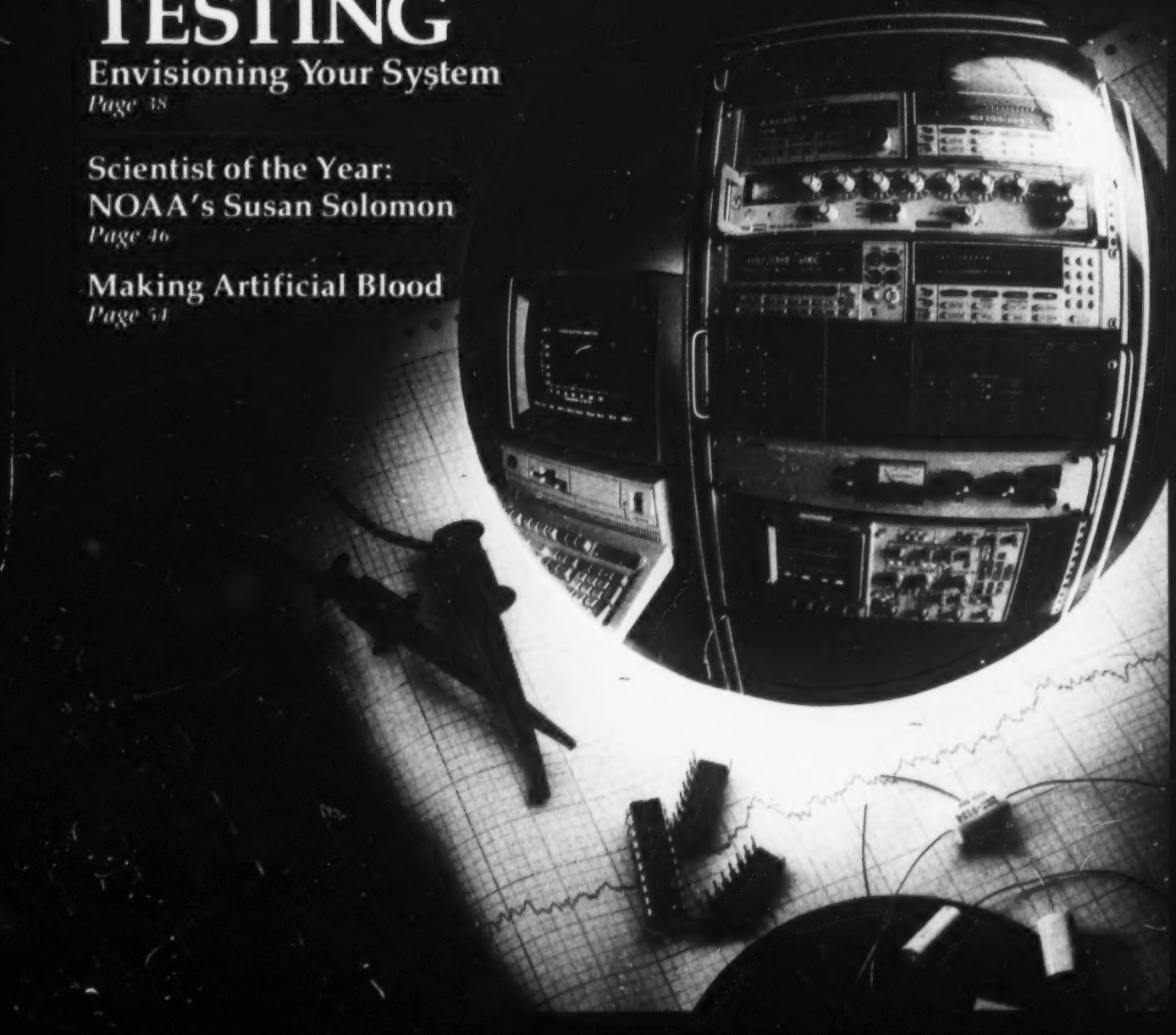
R&D
Research & Development

ELECTRONIC TESTING

Envisioning Your System
Page 38

Scientist of the Year:
NOAA's Susan Solomon
Page 46

Making Artificial Blood
Page 54



Self-pitching propeller, page 25

DEPARTMENTS

IN BRIEF	5
EDITORIAL Is U.S. industry's R&D glass half empty or half full?	15
BUSINESS Quality programs do double duty. Ceramic products replacing metal.	19
NEWS Large-scale solar project may be on the horizon.	24
INDUSTRY EVENTS	32
INNOVATIVE NOTEBOOK Art in pubic places.	35
MANAGEMENT Five tips on managing R&D in hard economic times.	71
NEW PRODUCTS	72
SALARY SURVEY	83
PRODUCT CENTER	92
LITERATURE	95
SOFTWARE REVIEW	99
SOFTWARE	100
ADVERTISERS INDEX	103
RESEARCH TRENDLETTER	109
READER SERVICE CARD	105

ABOUT THE COVER Gaze into our crystal ball and see the right way to design your test and measurement system—without the source errors. *Photo: Keithley Instruments, Solon, OH.*

R&D

The International Magazine of Research and Development

FEATURES

TEST & MEASUREMENT

Envisioning Your Test System? Watch for Error Sources! 38

Peer into this expert's crystal ball and learn how to penetrate the mysteries of designing a test and measurement system.

Scientist of the Year, page 46

R&D AWARDS

How Susan Solomon's Research Changed Our View of Earth 46

The NOAA chemist who discovered a critical link between CFCs and the ozone hole and then tested her theory in Antarctica has been named *R&D Magazine's* 27th Scientist of the Year.

BIOTECHNOLOGY

Pulse Quickens In Search for Blood Substitute 54

Substitutes that mimic blood's oxygen-carrying ability are racing to obtain FDA approval. The substitutes are free of HIV and hepatitis.

VACUUM TECHNOLOGY

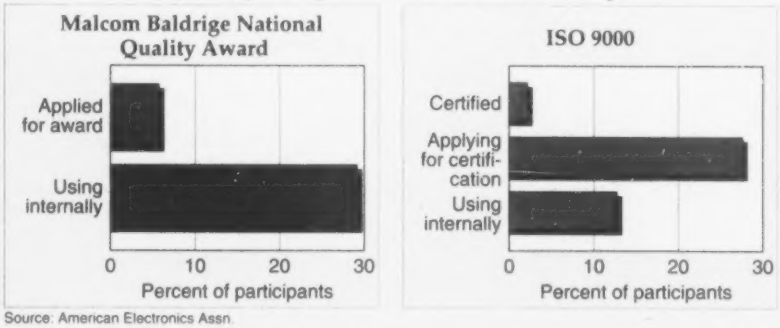
Selecting a Dry Pump Is No Easy Matter 63

You should talk to users as well as dry pump makers to zero in on the cost of ownership.

Artificial blood, page 54

COMING IN OCTOBER ... The R&D 100 Awards program celebrates its 30th Anniversary, featuring the 100 most technologicially significant new products, processes, and inventions of the year.

Quality Programs Do Double Duty



Source: American Electronics Assn.

***Many companies use the Baldrige Award and ISO 9000** application criteria as internal quality manuals in addition to using them for an award or certification.*

Getting Process Improvements From New Quality Programs Takes Time

Quality is the most important factor in the competitive success of high-technology companies, according to a recent survey by the American Electronics Assn., Santa Clara, CA. Quality was ranked first by 87% of the 456 respondents. Customer service was selected by 59% and having the latest technology was third with 43%.

The survey reveals that while 75% of the respondents are implementing total quality management (TQM) programs, relatively few have reduced the number of defects in their production output. The survey notes that the average number of in-house defects was reduced only 17% in 1992. A similar survey in 1988 revealed a larger defect reduction of 39%. The survey noted that results from TQM programs historically take time.

Interestingly, the percentage of respondents using TQM programs dropped from 86% in 1988 to 75% in 1992. Use of other programs, such as computer integrated manufacturing also declined over the same period.

The survey also noted that the Malcom Baldrige National Quality Award and the European Community's ISO 9000 Series are being used increasingly as quality standards, with more than half of the respondents saying they are using one or the other.

For a copy of *1992 Productivity Survey* ($55), write to Pittiglio Rabin Todd & McGrath, 1503 Grant Rd., Mountain View, CA 94040. □

Ceramic Products Replacing Metal

Continuing Japanese ceramic research is leading to larger and more complex ceramic parts. NGK Spark Plug Co. and Garrett Automotive Group announced last December that they had jointly developed a large rotor for use in the turbochargers of Caterpillar Inc.'s 460-hp diesel truck engines. The rotor has a 96-mm OD and is made of sintered silicon nitride.

The new rotor is 40% lighter than a metal rotor and has a lower moment of inertia. This results in faster turbocharger response, according to NGK. The ceramic material also is more corrosion resistant than metal.

While other ceramic parts, such as valves and sensors, are increasing in use, research also is continuing on development of complete ceramic engines. Isuzu researcher Hideo Kawamura believes the higher combustion temperatures of ceramic engines will eventually result in lower NO_x emissions and boost fuel efficiency by as much as 30%. While the materials and structure of the ceramic engine are fairly well established, the engine design has combustion problems at elevated temperatures. Commercialization is years away.

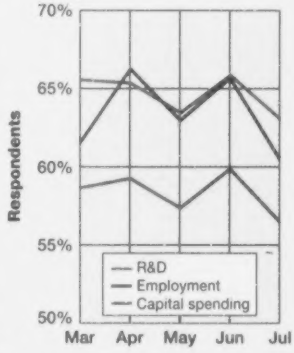
Japan's Ministry of International Technology and Trade is supporting research into ceramic gas turbine engines in cooperation with major oil companies and automakers. The ministry expects to provide $77 million over seven years. The project continues through 1997. —*Dennis Normile*

Business continues

Moderate Growth for SEMs

The market for scanning electron microscopes (SEMs) is forecast to grow nearly 6% annually to about $300 million in 1996, according to a recent survey by Strategic Directions Intl., a Los Angeles-based consulting firm.

SEM sales make up about half of the total market for electron microscopes. One of the hottest current products is the environmental SEM which examines organic samples.



Confidence Wavers

Instability in the current financial environment lowered corporate executives' confidence in their ability to maintain R&D, capital spending, and employment, according to a recent survey by Cahners Economics, Newton, MA.

In July, about 63% of the respondents indicated they would maintain or increase their R&D efforts, a 2.8%-point drop from June levels.

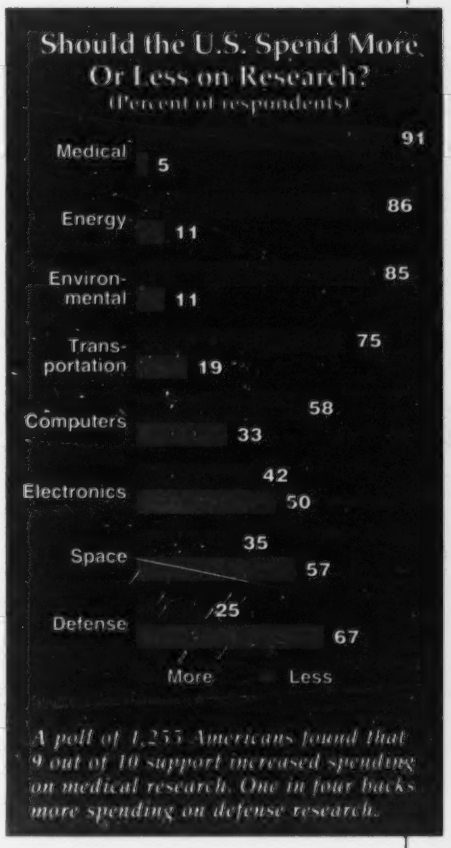
New Boat Propeller Design Is Efficient

Alan Underwood of Brunton's Propellers Ltd., Sudbury, England, inspects the blades of the world's first self-pitching propeller, a device for boat propulsion.

In operation, the Autoprop propeller blades find an equilibrium position by balancing the hydrodynamic and centrifugal forces at each revolution, no matter which direction the propeller is turning.

That is, the blades automatically adjust pitch to deliver thrust at a reduced number of revolutions per minute, which saves fuel.

When the boat is under sail only, the propeller blades automatically feather to the water flow, adopting the line of least resistance, independent of the angle of the propeller shaft.



A poll of 1,255 Americans found that 9 out of 10 support increased spending on medical research. One in four backs more spending on defense research.

to determine the reason for the supplement's behavior.

The Mississippi program sought to find out why Ester-C showed more bioactivity than common vitamin C compounds such as ascorbic acid. When the tests pointed to threonate, it was something of a surprise, Verlangieri told *R&D*. Threonate had been known only as a component in the preparation of a certain kind of bread in England.

"When ascorbic acid was added to the bread, threonate was produced, which acted to reduce the time needed to make the loaves," Verlangieri says. "It was known that threonate was a degradation product of vitamin C, but it was always thought it didn't do anything. Now we know that isn't true."

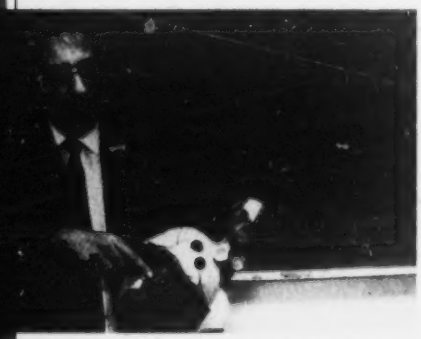
Once the researchers realized that threonate raised the bioactivity of Ester-C, possible uses were considered. The thought was that by adding it to other compounds, the cellular absorption rate might be increased.

In early work, threonate was added to a variety of organic acids for evaluation. The tests indicated it provided a 50% to 200% absorption increase compared with nonthreonate groups in aspirin, the arthritis drug piroxicam, and vitamin C.

As part of a pilot study, Verlangieri's team drew up a list of hundreds of compounds, including antibiotics, amino acids, chemotherapeutic agents, and anti-inflammatories. Preliminary screening suggests that 25% to 50% of that list can achieve substantially higher cellular intake if threonate is added.

Much of the detailed work to date has focused on the aspirin-threonate system. The results indicate the system can offer an effective way to eliminate unwanted side effects.

"Our thinking is that by greatly increasing transport and absorption in the gastrointestinal tract, lower doses of aspirin may be used to achieve the same medicinal effect," he says. "In essence you can take less of the drug and end up with the same therapeutic effect much faster than before." □



***Anthony Verlangieri** is studying threonate for use in drug delivery.*

Superconductivity Protecting Against Power Disruption

Superconductivity Inc., Middleton, WI, has started marketing its Superconducting Storage Device (SSD), believed to be the first commercial use of superconductor technology for power applications.

The SSD protects industrial processes from power sags or voltage outages by sensing those conditions and supplying required extra power. (Power loads in the megawatt range are difficult to protect with other equipment, such as battery systems.) Once there is a disturbance, the SSD can supply full power to the load in 4 msec.

Product manager James Emerick

R&D SOFTWARE

LabVIEW Now for Windows and Sun

The LabVIEW graphical programming software, available on Apple Macintosh computers since 1986, is now available on IBM-compatible PCs running Microsoft Windows 3.1 and Sun Microsystems SPARCstations running MIT's X Window System or OpenWindows Version 3.

LabVIEW is a general-purpose programming tool that allows researchers to build software modules called virtual instruments, instead of writing text-based programs. Applications developed for either Windows or SPARCstations are completely portable to the other.

Both versions feature a library of ready-to-use controls, graphs, and strip charts for building custom interfaces and control panels. Icon libraries are available for controlling more than 100 GPIB, VXI, and RS-232 instruments. The Windows version also has a library for controlling data acquisition, signal processing, and signal conditioning hardware.

LabVIEW versions for Windows and Sun SPARCstations allow researchers to build control panels for various instruments using icon-based programming modules.

Compared to the Macintosh version, the Windows/Sun versions add a new sweep chart for faster plotting speeds, a fast waveform graph, and multivalued numeric controls.

LabVIEW for Windows requires a 386 PC with 387 coprocessor, 8-MB RAM, and DOS 5.0. LabVIEW for Sun requires 24-MB main memory and 32-MB disk swap space. It does not require Motif or OPEN LOOK.

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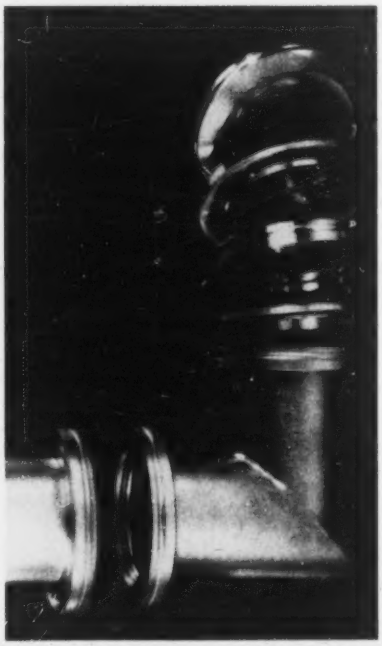

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For information circle **105**

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